NASA ENERGY AND WATER CYCLE STUDY (NEWS)

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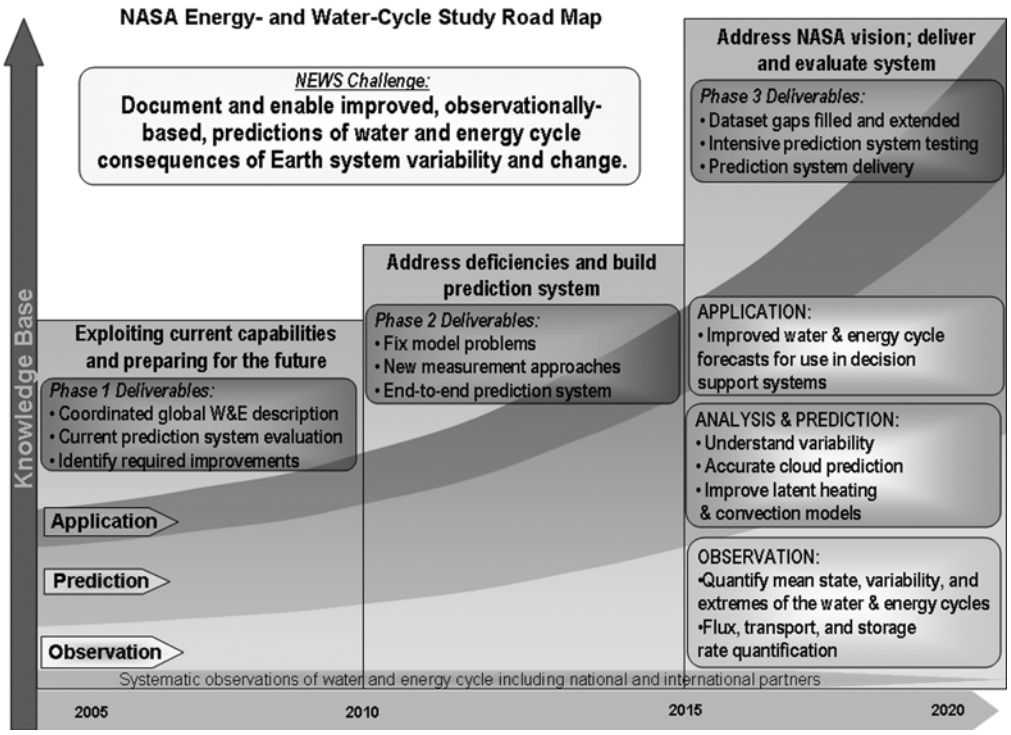
Water is essential to life and is central to society's welfare, progress, and sustainable economic growth. The water cycle operates on a continuum of time and space scales and exchanges large amounts of energy as water undergoes phase changes and moves through the Earth system. Furthermore, it is widely recognized that the most significant manifestation of climate change for humans and the environment is an intensification and alteration of the global water cycle, leading to increased global precipitation, faster evaporation, and a general exacerbation of extreme hydrologic regimes, floods, and droughts. Therefore, it is essential that we produce an accurate accounting of the key reservoirs and fluxes associated with the global water and energy cycle, including their spatial and temporal variability, and potential response to climate change.

With its unprecedented new observation capacity, and revolutions in modeling capability, the National Aeronautics and Space Administration (NASA) has an opportunity to make significant advances in water and energy cycle prediction. To realize this goal, NASA must develop its unique discipline of prediction and verification through the integration of water and energy cycle observations and models, and to verify model predictions against observed phenomena to ensure that its research programs deliver reliable answers to societies' questions. To this end, the NASA Energy and Water cycle Study (NEWS), has been established to document and enable improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change.

To achieve the NEWS grand challenge and produce credible climate change predictions, NASA will seek collaborations with international, federal, state, and local agencies, as well as the scientific community-at-large. This will be primarily accomplished through the interagency working group for the water cycle under the Climate Change Science Program (CCSP). Such collaborations will include studies and activities concerning experimental and operational observations and analysis tools for characterizing air/sea fluxes, ocean circulation, atmospheric state, land surface vegetation, sub-surface hydrology, snow and ice. The development of an end-to-end water and energy cycle program that improves decision support with new research products and tools will also be supported.

NASA's water and energy cycle connection to the international science community is through the World Climate Research Programme (WCRP), especially GEWEX, as well as the project on CLImate VARiability and predictability (CLIVAR), the CLimate and Cryosphere (CLiC) Project, the Global Water Systems Project (GWSP), the Integrated Global Observing Strategy (IGOS), and the Global Earth Observation System of Systems (GEOSS).



Implementation of the NEWS research program is planned in three phases with each successive phase being focused on a range of research activities, representing advances beyond the current status of observations, modeling and applications. The centerpiece of this plan is the development of an observation-driven Earth system model that faithfully represents water and energy cycling, climate trends, and

weather-scale variability including extremes. The emphasis during Phase 1 is to exploit current capabilities and prepare for future developments of NEWS program elements. Phase 2 focuses on addressing deficiencies and building a viable prediction system. Phase-3 focuses on the delivery of an end-to-end system.

Recognizing that the development of useful water and energy cycle predictions is a significant challenge that independent investigations are unlikely to meet, NEWS is adopting a tightly-integrated team approach to this research challenge. The three principal NEWS elements are:

- **Product-driven investigations:** Systematic research investigations intended to combine and interpret past and current observations, derive global analysis and prediction tools and products and identify technological and observational requirements to guide future NASA investments.

- **Discovery-driven investigations:** Fundamental investigations to identify key missing elements and explore new scientific frontiers to improve capabilities and knowledge of the energy and water components of the Earth system.

- **Integration studies:** Integration of the science activities to serve the overall purpose of NASA by acting as an interface with other earth science research foci and activities, coordinating the execution of the NEWS Implementation Plan, and leading specific studies needed for integration of the results of independent NEWS investigations.

NASA has recently selected 21 NEWS product and discovery research projects, which are expected to interact as a tightly coordinated team to make decisive progress toward the NEWS grand challenge. NASA has also established a NEWS Science Integration Team that will serve as an interface to NASA system components, and to coordinate and integrate the results of the NEWS investigations.

We invite community participation to enhance the NEWS program through involvement in open NEWS workshops and townhall meetings, critical reviews and edits of the NEWS Implementation Plan, partnerships with the NEWS investigators and integration team, and participation in future NEWS research solicitations. Information on these opportunities can be found at the NEWS web site: http://wec.gsfc.nasa.gov.

OBSERVING SURFACE WATER FROM SPACE: WatER MISSION

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Surface fresh water is essential for life, yet current observing networks provide surprisingly poor knowledge of the spatial and temporal dynamics of water storage and discharge in the world's rivers, floodplains, wetlands, and lakes. Key societal issues, such as the susceptibility of life to drought and floods, cannot be answered with the current global observing networks. Alsdorf and Lettenmaier (2003) and Alsdorf et al (2003) outlined the potential for spaceborne observations via methods that have been used to define the surface profile of the world's oceans for several decades to address these issues. The Water Elevation Recovery (WatER) mission, a proposed joint European Space Agency (ESA) and National Aeronautics and Space Administration (NASA) program, would acquire elevations of water surfaces at spatial (10-100 m) and temporal (1 week) scales necessary for answering key water cycle and water management questions.

The WatER mission concept was developed after a 1998 NASA effort to define post-Earth Observing System satellite missions when NASA's Terrestrial Hydrology Program formed a Surface Water Working Group (SWWG; www.geology.ohio-state.edu/swwg) to foster development of satellite applications to surface water problems. SWWG encouraged the development of spaceborne technologies capable of collecting global surface water measurements that would help address existing voids in global surface water observations (Alsdorf et al., 2003). Similarly, a community of researchers throughout Europe met at the Hydrology from Space Workshop at the Centre National d'Etudes Spatiales, (CNES) in Toulouse in September 2003 and initiated actions intended to lead to a spaceborne platform capable of measuring surface water hydrology.

WatER is an interferometric altimeter based on the rich heritage of (1) the many highly successful ocean observing radar altimeters, (2) the Shuttle Radar Topography Mission (SRTM), and (3) a development effort for a Wide Swath Ocean Altimeter. WatER would provide surface elevation data in a